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A REVISION OF THE INDO-MALAYAN SPECIES
OF CEDRELA.

BY
C. DE CANDOLLE.



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A REVISION OF THE INDO-MALAYAN SPECIES OF CEDRELA.

—♦—
By

C. DE CANDOLLE.
—♦—

INTRODUCTION.

The genus *Cedrela* was first founded by Linnæus on *Cedrela odorata*, a West-Indian species in which the receptacle of the flower is very much elongated and which has seeds winged at their lower end only. An Indian and a Javanese species having a much shorter receptacle and seeds winged at both ends were afterwards added to the genus by Roxburgh and Blume. Then A. de Jussieu and Royle again added to it two Asiatic species having also a relatively short receptacle but the seeds of which have afterwards been found to be winged only at their upper end. Later on Roemer¹ detached all the species with a short receptacle from the *Cedrelas* and formed with them his genus *Toona*. The subsequent writers, however, continued to include them in genus *Cedrela*, an arrangement which I adopted in my monograph of the *Meliaceæ*, published in 1878. On the contrary, Harms² has recently reverted to Roemer's classification.

Such was the state of things when I undertook the present revision with the help of the materials of the Calcutta herbarium which had been put at my disposal for that work. It was of course impossible for me to carry it out without examining anew the characters distinguishing the West-Indian and American from the Indian species, since on my opinion of the importance of these characters depended the generic name to be adopted for the latter. Thus I was led to extend my revision to the whole genus, and I must say that this study has confirmed me in the idea that there is such a close affinity between the species of the two groups, that it is quite natural to keep them together in the same

¹ *Synopses monographicae*, fasc. 1, p. 131.

² Engler und Prantl. *die natürlichen Pflanzenfamilien*, iii, iv, p. 267.

genus. In that respect the striking elongation of their floral receptacle particularly deserves to fix the attention. It constitutes a thick column along which the petals are attached by means of a prominent ridge. It has been variously called by the authors: a disk, a stipes, a gynandrophore, a gynophore,—but none of these terms is really appropriate to it. In the first place that elongated receptacle is not homologous with the organs habitually designated as disks, for they are of appendicular nature, and, secondly, the fact of its being concrescent with the petals excludes the other denominations just mentioned. So a new term was to be found for it, and I, long ago, adopted that of *column*, suggested to me by the expression "*Receptaculum columnare*" formerly applied by Patrick Brown¹ to that special structure characterizing the flowers of all *Cedrelas*. It is true that the column is much shorter in the Asiatic and Malayan species than in the others. But such a vague character as the relative length of an organ cannot, in my opinion, be looked upon as having the value of a generic character.

Now there is in the structure of the column itself a detail to which sufficient attention has not been paid yet. It consists in a curious concrescence of the top of that organ with the base of the carpels; the consequence of that concrescence being that the cells of the ovary get prolonged inside the column, so far down as to a little below the insertion of the stamens; this character has first been noticed by Harms² in *Toonas*, and I have since ascertained that it exists in all *Cedrelas* without an exception. In other words, it can be said that in all of them *the ovary is partially inferous*. That being so, it now seems more natural to compare the length of the column to that of the cells than with that of the visible part of the ovary, and I shall do so henceforth in my descriptions.

It is to be remarked that in almost all the species the ovules are all inserted in the upper part of the cells, that is to say, outside the column. In only three of them, of which one is American (*C. bogotensis*) and the others Indian (*C. Toona* var. *Pealii*; *C. Mannii*), did I find that the lowest ovules are inserted in the inferous portion of the ovary. But in these species, as in all the others, that portion remains rudimentary during the evolution of the fruit, the capsule being entirely formed by the magnified free portion of the ovary. On the other hand the prolongation of the cells into the column, although so very slightly marked and apparently useless, gains a systematic importance from the fact of its being a character common to *all* the species.

¹ History of Jamaica, p. 158.

² l. c., p. 269.

As above stated, the present revision is principally based on a study of the specimens preserved in the Calcutta herbarium. But although I have thus had at my command the best materials at present available, it has unfortunately not been possible for me to settle, as fully as I hoped to be able to do, many points concerning the Indian Cedrelas. There are, for instance, in that rich collection several specimens which I should certainly have considered as specifically distinct from *C. Toona*, were it not that there are also various forms intermediate between them and the latter species. Moreover, some of these specimens are incomplete and they seldom correspond to the same phases of vegetation. All this has greatly puzzled me for a long time, and I finally adopted the plan of adding to the type of *C. Toona* a rather lengthy series of varieties, instead of creating new species which would unavoidably have been founded on insufficient characters. Among the few new species described in this paper *Cedrela Hainesii* deserves a special mention on account of the presence of staminodes in its flowers. It is greatly to be desired that fruiting specimens of that species should be obtained, for it would be interesting to know if its seeds are winged at their upper end only as it is the case in *C. sinensis* and in *C. serrata*, the only other two Cedrelas the flowers of which are also provided with staminodes.

Key to the Indo-Malayan species.

A. Flower containing 5 staminodes besides the 5 stamens.

I. Column and ovary glabrous, calyx cupulate.

† *Leaflets of the adult tree entire or very sparingly denticulate at the edge—*

Adult leaflets glabrous on both surfaces

1. *sinensis* A. Juss.

†† *Leaflets of the adult tree serrate at the edge—*

Adult leaflets glabrous on both surfaces.

Anthers cordate at the base 2. *serrata* Royle.

Adult leaflets shortly hairy underneath.

Anthers sagittate at the base *serrata* var. *puberula* C. DC.

II. Column and ovary hirsute, calyx dialysepalous—

Adult leaflets glabrous on both surfaces, entire at the edge

3 *Hainesii* C. DC.

B. Flower containing no staminodes—

(Leaflets entire at the edge in all the species except in No. 4 var. *v* and in No. 9.)

a. Calyx dialysepalous, column hirsute.

Adult leaflets quite glabrous on both surfaces or pubescent only on the nerves—

Pedicels and calyx puberulous or

glabrous 4. *Toona* Roxb. and vars.

Pedicels and calyx densely hirtel-

lous 5. *microcarpa* C. DC.

Adult leaflets pubescent on both surfaces and more densely so underneath—

Base of leaflets tapering on both sides 6. *Kingii* C. DC.

*b. Calyx cupulate, dentate.**1°. Column and ovary hirsute—*

Leaflets moderately petiolulate, ovate-

lanceolate, the base tapering below,

rounded above 7. *febrifuga* Bl. and vars.

Leaflets very shortly petiolulate,

oblong; the base rounded on both

sides 8. *Mannii* C. DC.

2°. Column and ovary glabrous—

Leaflets subremotely serrulate at the

edge, the base tapering on both

sides 9. *longifolia* Wall.

1. C. sinensis A. Fuss.; Mém. Mel., 142.

Leaflets 5-6 on each side, opposite or alternate, petiolulate, ovate-oblong, acutely acuminate, entire or remotely serrulate at the edge, the base tapering below, rounded and longer above, both surfaces glabrous; rhachis puberulous; panicles as long or longer than the leaves, pendulous, densely puberulous; flowers shortly pedicellate; calyx cupulate, sinuate-crenate when adult, glabrous outside, appressedly puberulous inside, ciliolate at the edge; petals ovate-oblong, rounded at the base, obtuse at the top, glabrous; filaments glabrous; anthers shorter than the filaments, elliptic, cordate at the base, connective apiculate;

staminodes 5, filamentose; column and ovary glabrous; seeds with a wing at the upper end only.—Decaisn. in *Compte-rend.* 83, p. 266; C. DC. in *Mon. Phan.* 1, p. 743.—*Toona sinensis* Roem. Syn., fasc. 1, p. 138; Harms in *Engl. Pr. Pflanzenf.*, iii, iv, p. 269.

A tree, wood reddish, branchlets glabrous, dark-reddish with pale lenticels when dry. Leaves impari-pinnate in seedlings, afterwards pari-pinnate, up to 50 cm. long. Leaflets firm, smelling of garlic when crushed, up to 13.5 cm. long, 3.5 cm. wide, upper and lower ones gradually smaller, those at the base oval; secondary nerves subspreading substraight, about 18 on each side. Petiolules 7-10 mm. long. Rhachis terete. Petiole terete, 7 cm. long. Lower branches of the panicle up to 20 cm. long, alternate, upper ones opposite. Pedicels up to .75 mm. long. Calyx membranous, 1 mm. long. Petals 4-5 mm. long, 2-2.25 mm. wide. Filaments 2-2.5 mm. long. Anthers .75--1.25 mm. long. Column shorter than the cells of the ovary. Ovary 5-celled or sometimes 4-celled, cells 8-ovulate. Panicle when fruiting black-reddish with pale lenticels. Capsule about 2 cm. long, 8 mm. wide, black-reddish with minute pale lenticels. Seeds about 12 mm. long, wing 10 mm. long, 5 mm. wide.

China, near Peking (*Dinkarville*, h. Juss.; *Bunge*, h. Cand.; *David*, h. Berol.; *Skatschkoff*, h. Calcutt., Petrop., Berol., Boiss.; *Bretschneider*, h. Berol.); Cima del Tui-Kio-fan in Chen-Si septentrionali (*G. Giraldi* n. 4351, *ibid.*); central China, prov. Szech'uan, Wanch'uan (*v. Rothorn* n. 910, *ibid.*); Japonia, (*Osumi*, h. Boiss.).

Prov. Yunnan, Szemao, alt. 4,000 ft. (*A. Henry* n. 12807, h. Calcutt., h. Kew).

b. Hupehana. n. var.; calyx inside more hirsute, petals oblong, only 1.5 mm. wide.

• Prov. Hupeh (*A. Henry* n. 3657, h. Calcutt.).

c. Schensiana, n. var.; leaflets pubescent on both surfaces, the hairs longer and more dense on the nerves underneath; ripe panicle puberulous.

Schensi septr. dalla falda alla metà del Toe-peï-san (*G. Giraldi* n. 4352, h. Berol.).

2. C. serrata Royle; *Ill.*, p. 144, tab. 25.

Adult leaves glabrous; leaflets 11-14-jugate, opposite, petiolulate, oblong-elliptic or oblong-lanceolate, acutely and rather long acuminate, serrate at the edge; the base tapering on both sides, longer and wider above; panicle longer than the leaves, long branched, ultimate branches hirtellous; flowers pedicellate; calyx cupulate, dentate, glabrous outside, appressedly puberulous inside, the lobes rounded, obtuse or subacute

quite at the top, ciliolate at the edges; petals elliptic-oblong, truncate at the base, obtuse at the top, glabrous; filaments glabrous, anthers shorter than filaments, oblong, emarginate at the base, the connective apiculate; staminodes 5, filamentose; column and ovary glabrous; seed with a wing at the upper end only.—Brandis For. Fl., p. 73; Ind. Tr., p. 145; C. DC. Monog. Phan. 1, p. 742; Koord. et Val. Bijdr. 3, p. 205; Gamble Man. Ind. Timb., p. 160. *C. serrulata* Miq. Flor. Ind. Bat., supp., pp. 198 et 508; Ann. Mus. Bot. iv, p. 64; C. DC. l. c. p. 746. *C. Toona* Hiern Fl. Brit. Ind. 1, p. 568, in p.—*Toona serrata* Roem. Syn., fasc. 1, p. 139.

A tall tree, bark dark-grey (Gamble l. c.), branchlets glabrous, dark-reddish when dry, with few and pale lenticels or elenticellate. Leaves impari-or-abruptly-pinnate, up to 50 cm. long. Leaflets membranous, intensely dark-green (Koord. et Val. l. c.), about 13 cm. long and 4 cm. wide; secondary nerves subspreading, straight, about 25 on each side. Petiolules 5 mm. long. Rhachis terete. Petiole terete, 9 cm. long. Panicle up to 1.25 m. (Koord l. c.) long, the lower branches up to 16 cm. long, close from the base, remotely ramulose. Pedicels glabrous up to 1 mm. long. Calyx 1 mm. long. Petals 5.5 mm. long, 1.5-2 mm. wide. Stamens occasionally 6 (Brandis l. c.), filaments 2 mm., anthers 1.25 mm. long. Column shorter than the cells of the ovary. Ovary 5-celled, cells 8-ovulate. Capsule obovate-fusiform, about 2.5 cm. long, glabrous, smooth, nigrescent when dry, with few pale lenticels. Seeds about 16 mm. long.

"The great clusters of flowers appear in May and June, and the seed ripens in August, has on the Sutlej the smell of the pencil-cedar when fresh cut, at times said to have a strong fetid smell. The wood is lighter-coloured and more open in the grain than that of the *Toona*, but much like it in appearance. The hoops of sieves are made of it, it is also used for bridges. Shoots and leaves are lopped for cattle-fodder." (Brandis l. c.)

India (Royle, h. Petrop.); North-West India (h. Royle, in h. Calcutt.); valleys of the Himalaya, extending to the Indus, and ascending to 8,000 ft., in moist, shady places (Brandis l. c.); Simla, Gowai, alt. 5,500 ft., Annandale, alt. 7,000 ft. (J. S. Gamble n. 569, 25535, h. Calcutt.); prope Mussourie N. W. Himalaya (G. King, *ibid.*); Sao Valley, alt. 5,000 ft. (Lace n. 961, 1707, *ibid.*); Tamsa, Chakrata, alt. 7,000 ft., flowering in June (Gamble n. 27070, *ibid.*); Almorah (G. King, *ibid.*); Kumaon, Baramula pass (R. Strachey et J. E. Winterbottom, *ibid.*); prope Chergaon in Kunawar (Brandis l. c., p. 573); Manipoor, Jaccoma, alt. 4-6,000 ft., fructifying in May (G. Watt n.

7243, h. Calcutt.); upper Burma, on the hill east of Maymyo, January fruiting (*J. C. Prager*, *ibid.*); Hort. Bogor. culta (n. 384, h. Berol. ex h. Lugd. bat.); Java, Gedé, alt. 520 ft. (*H. O. Forbes*, h. Calcutt., Berol.); Sumatra, Lobualang (*Teysm.*, h. Calcutt. ex h. Lugd. bat., *H. O. Forbes* n. 1209, h. Berol.); Hort. Bogor, e Sumatra (*Hochr.* Pl. Bogor-exsicc. n. 158, *a* and *b*).

β. puberula n. var.

Leaflets puberulous underneath, mainly on the nerves; petiolules and rhachis puberulous; panicles puberulous when young, afterwards nearly glabrous even on the ultimate branchlets; lobes of the calyx subacute or acute; anthers about as long as the filaments, oblong, sagittate at the base, the connective hardly apiculate.

Petals 5 mm. long, 2 mm. wide. Filaments 1.5 mm., anthers 2 mm. long. Ovary 5-celled or sometimes 4-celled, cells 6-ovulate.

N. W. Himalaya, Sains-Givi (*D. Brandis* n. 875, h. Cand.); Ganges Valley below Dangulla, 7-8,000 ft. (*J. F. Duthie* n. 1102, h. Boiss.).

3. C. Hainesii n. sp.

Leaflets 11-jugate, opposite or subopposite, petiolulate, lanceolate, somewhat long and acutely acuminate, entire at the edge; the base acute and of same length on both sides, a little wider above; both surfaces puberulous principally along the central nerve when young, afterwards glabrous; petiolules and rhachis puberulous when young, afterwards glabrous; panicles shorter than the leaves, puberulous, pedunculate, loosely pyramidically branched; branchlets loosely floriferous; flowers pedicellate, pedicels glabrous; sepals rounded, puberulous outside, ciliolate at the edge, petals oblong-elliptic, obtuse at both ends; filaments glabrous; anthers shorter than the filaments, oblong-elliptic, cordate at the base, the connective shortly apiculate; column and ovary hirsute; style glabrous.

Branchlets sparingly hirtellous, reddish when young, elenticellate. Leaves about 50 cm. long. Leaflets up to about 10 cm. long and 3 cm. wide, the point 1.5 cm. long; secondary nerves spreading-subascendent, thin, about 15 on each side. Petiolules nearly 7 mm. long. Rhachis terete. Petiole terete, 11.5 cm. long. Panicle branched from nearly 3 cm. above its base; the lower branches about 14 cm. long. Pedicels 1 mm. and sepals about 1.25 mm. long. Petals 4-4.5 mm. long, 2.5 mm. wide. Filaments 1.25 mm., anthers .75 mm. long. Staminodes 5, filamentose. Ovary 5-celled, cells 6-ovulate.

Singbhum (*Haines* n. 189, 357, h. Calcutt.).

4. *C. Toona* Roxb. ex Rottl. et Willd. in Ges. Naturf. Fr. Neue Schr., iv, p. 198.

Leaflets 6-12-jugate, opposite or subopposite or even sometimes alternate, somewhat long-petiolulate, lanceolate or ovate-or-oblong-lanceolate, acutely acuminate, entire at the edge; the base a little longer above, tapering on both sides or subrounded above; upper surface glabrous, the lower pilose in the axils of the secondary nerves only; petiolules, rhachis and petiole glabrous; panicle about as long as the leaves, shortly pedunculate or nearly epedunculate, somewhat loosely and moderately long branched, puberulous; flowers shortly pedicellate, pedicels puberulous; sepals rounded-ovate, subacute at the top, puberulous outside, ciliate at the edge; petals ovate-oblong or oblong, obtuse at the base, subacute at the top, glabrous on both surfaces, ciliate at the edge; filaments glabrous; anthers shorter than the filaments, oblong, cordate at the base, the connective apiculate; column and ovary densely hirsute, style glabrous; capsule elliptic-oblong, elenticellate, seeds winged at both ends.—Roxb. Pl. Cor. iii, p. 34, tab. 238, Fl. Ind. i, p. 635; Wight et Arn., p. 124; Wight Ic., tab. 161; Bedd. Fl. Sylv., tab. 10; A. Juss. Mém. Mel., p. 103?; Hiern. Fl. Brit. Ind. i, p. 568 in p.; Brandis For. Fl., p. 72, Ill. tab. 14, Ind. Tr., p. 145; Kurz For. Fl. i, p. 228; C. DC. Mon. Phan. i, p. 745 (syn. A. Juss. et Forst. excluded); Grah. Cat., p. 246; Dalz. et Gibs., p. 38; Talb. Trees of Bomb., p. 43 (f. Cooke l. c.); Cooke Fl. Pres. Bomb. ii, p. 217; Gamble Man., p. 157.—*Toona ciliata* Roem. Syn., fasc. i, p. 139; Harms in Engl. Prantl. Pflanzf. iii, iv, p. 270. *C. hexandra* Wall.—*Surenus Toona* O. Ktz. Rev. i, p. iii.

A deciduous or nearly evergreen (Brandis l. c.) tree, 60-70 ped. high; bark thin, dark grey (Brandis l. c.). Branchlets puberulous when young, then glabrous, reddish when dry, sparingly lenticellose. Leaves up to 38 cm. long. Leaflets 11-12 cm. long, 3.5-4 cm. wide; secondary nerves thin, spreading-ascendent, about 18 on each side. Petiolules 8-12 mm. long. Rhachis terete. Petiole terete, 6 cm. long. Lower branches of the panicle up to 12 cm. long. Pedicels 1 mm., sepals about .8 mm. long. Petals 3.5-4.5 mm. long, 2-2.5 mm. wide. Filaments 1.5 mm., anthers .75 mm. long. Staminodes 0. Column shorter than the cells of the ovary. Ovary 5-celled, cells 8-10-ovulate. Capsule about 2 cm. long, blackish when dry. Seeds 15 mm. long, both wings oblong-ovate obtuse or subacute at the top, the upper one a little shorter than the other.

North-Western Himalaya (Royle, h. Calcutt.); Chamba to Ralegh (F. H. Lace n. 1410, h. Calcutt.); East India (R. Wight, h. Berl.);

Belaspore (*Stoliczka*, h. Calcutt.). Simla, alt. 3,000 ft. (*J. S. Gamble* n. 568, *ibid.*); Nepaul (*Wall.* n. 1272, h. Deless; 1272E, 1272-1, h. Calcutt.); East Himalaya (*Griffith* n. 1030-1, h. Calcutt., h. Monac., h. Holm.); Summit Paras nath (h. Calcutt.); Sikkim (*G. King*, *ibid.*); Khasia, alt. 2-3,000 ft. (*Hook. f.*, *Thoms.*, *ibid.*, h. Cand.); outer Khasia hills below Chirung (h. Calcutt.); Sylhet (*C. B. Clarke* n. 7172, *ibid.*); Prov. Bombay (*O. Hoffmann*, h. Berl., with capsules only 2 cm. long.); hort. bot. Calcutt. (*Kurz*, *ibid.*); Ganja Mahal (*D. Prain*, *ibid.*); Rajpore (*S. Kurz*, *ibid.*); Ghát (*J. S. Gamble*, *ibid.*); Nilgiris, Carnon. alt. 3,000 ft.; Assam, Goalpara (*C. B. Clarke* n. 43149 B., *ibid.*, n. 43149A, h. Berol., Cand., Boiss.); Assam (*Fenkin*, h. Calcutt.); Jeypore (*D. Prain*, *ibid.*); Dukkinishur (*Clarke* n. 34531, h. Boiss.); Chittagong, a tree 90-100 ft. high (*Dr. King's collect.*, *ibid.*; *J. S. Gamble*, *ibid.*); Tenasserim circle (*ibid.*). Java (*Horsefield*, *ibid.*).

Largely cultivated in India, cultivated also in Mauritius (Bojer, h. Cand.). The following varieties are to be distinguished from the type.

A.—Branchlets and adult leaves as in the type.

(a) Column and ovary hirsute.

1. *Filaments glabrous.*

β. nepalensis n. var.

Sepals a little longer than in the type; petals up to 5 mm. long and up to 3 mm. wide; capsule smaller than in the type, about 1.5 cm. long.—*C. hexandra* Wall. in Roxb. Fl. ed. Car., p. 225.

Nepaul, 1821 and 1823 (*Wall.* n. 1272, h. Deless., spec. florif. et spec. fructif.; 1272, A. h. Mus. Par.).

γ. pilistila n. var.

Leaflets obliquely oblong-elliptic, acutely acuminate, the base tapering and of same length on both sides; panicle shorter than the leaves, subglabrous, somewhat densely branched from near the base; sepals glabrous, ciliate at the edge; style sparingly hirsute nearly up to the top.

Shevaroi hills (*Perrottet* n. 239, 240 (or 89?), h. Calcutt.).

δ. latifolia *Miq. in Hohen. Exsicc.*, n. 1539.

Leaflets ovate, up to 6 cm. wide, acutely acuminate, rounded towards the base on both sides, or subattenuate at the base below, extreme base acute and of same length on both sides; petals up to 5.5 mm. long, and to 2.5 mm. wide; filaments up to 2.5 mm., anthers up to 1.5 mm. long.—*C. Toona* C. DC. Mon. Phan. l. c.

Mount Nilagiri, prope Melur, incolis Kilichin-Mara (*Hohen* n. 1539, h. Cand., and the leaf only in h. Berol.); Nilghary hill (*T. Kist. Naidoo*, h. Calcutt.); Bangalore (ibid.); East India (*Wight* n. 422, ibid.); Nilgiris, Coonoor, alt. 9,000 ft. (*J. S. Gamble* n. 16241, with lowest leaflet obtusely dentate, ibid.).

2. *Filaments pilose.*

ε. *yunnanensis* n. var.

Leaflets opposite or alternate, up to 10 cm. long and to 4 cm. wide, the lower ones ovate, acutely acuminate and nearly equally rounded on both sides at the base; the others ovate-lanceolate, the base of same length on both sides, tapering or rounded below, rounded and wider above; petiolules up to 11 mm. long; petals 5 mm. long, 3 mm. wide.

Yunnan, Szemao Mounts (*Aug. Henry* n. 13001, h. Calcutt; Berl.).

ζ. *pilistaminea* n. var.

Leaflets as in the type; capsule smaller, 2 cm. long, 9 mm. wide, black when dry, with minute lenticels.—*C. febrifuga*, forma timorensis et forma ternatensis Miq. Ann. Mus. 4, p. 63.

Flowering specimens: Salsette, Bombay (*Law*, h. Dalzell in h. Calcutt.); Himalaya (h. Calcutt.); Dehra Dún (*B. Birbal*, ibid.); Kumaon (*G. King*, ibid.); Bilghy, Soonda (ibid.); Dinajpoor (ibid.); Jessore (*C. B. Clarke* n. 8369, ibid.); Shevaroi hills (*Ferrottet* n. 113, 238, ibid.); Khasia, Cachar (*Mann*, ibid.); Chittagong (*King*, ibid.); Manipur and lower hills, alt. 2-4,000 ft. (*G. Watt*, ibid.); Pegu, Toukgeghat (*Kurz* n. 1384, h. Calcutt.); Penang, Government hill (*C. Curtis*, h. Calcutt.); Java, Preanger (*Warburg* n. 3166, h. Berl.); Java (h. *Holm.*, h. Calcutt.).

Flowering and fruiting specimens. Ind. Bor. occ. (*Hook. & Thom.*, h. Berl.). Timor (*Spanoghe*, h. Calcutt. ex h. Lugd. Bat.); Ternate (*Teysman*, h. Calcutt.).

η. *deccana* n. var.

Leaflets as in the type, only longer acuminate, sepals rounded, glabrous, ciliate at the edge; petals obtuse at the top, 5 mm. long, 3.5 mm. wide, subcoriaceous when dry; Deccan (*T. Cooke* n. 179, h. Calcutt.).

θ. *cuspidata* n. var.

Leaflets opposite or alternate, up to 14 cm. long, and to $\frac{3}{4}$ cm. wide, subfalcate-lanceolate, long and acutely acuminate; the base tapering on both sides, longer and wider above; panicle nearly as long as the leaves, sparingly hirtellous, pyramidically branched; sepals

rounded-ovate, acute at the top; petals oblong-elliptic, acute at the top; capsule oblong-obovate, about 3.5 cm. long, sparingly lenticellate; upper wing of the seed shorter than the lower.

Upper Burma, Myitkyina (*Shaik Mokim* n. 29, h. Calcutt., h. Cand., floriferous specimens); India? (*Ritchie* n. 1660, h. Boiss, fructiferous specimen).

ι. *Stracheyi* n. var.

Leaflets oblong-lanceolate, acutely acuminate, the base tapering and of same length on both sides, 16 cm. long, 5 cm. wide; panicle minutely puberulous; sepals rounded, puberulous outside, ciliolate at the edge; petals ovate-oblong, obtuse at the top, very sparingly pilose on both surfaces.

Kumaon in Sarja valley, alt. 3,500 ft. (*R. Strachey*, *J. E. Winterbottom*, n. 1, h. Calcutt., specimen with only one leaf and a branch of the panicle).

κ. *pilipetala* n. var.

Leaflets up to 10 cm. long and 38 mm. wide, ovate-oblong, acutely acuminate, the base tapering below, rounded above, nearly of same length on both sides; panicle puberulous, dark reddish with pale lenticels when dry; sepals rounded, sparingly puberulous outside, ciliate at the edge; petals subovate-oblong, subacute at the top, pilose on the inner surface; style hirsute.

Nilghiris (*B. Schmid*, h. Calcutt. ex h. Kew.); Salsette, Bombay (*N. Dalzell*, h. Calcutt.).

(b) Column hirsute, ovary glabrous.

1. *Filaments glabrous.*

λ. *Gamblei* n. var.

Leaflets up to 9.5 cm. long and to 3.5 cm. wide, lanceolate, acutely acuminate, the base tapering on both sides, longer above, petiolules about 8 mm. long on the upper side; panicle shorter than the leaves, branched from the base, racemose above, puberulous; sepals rounded glabrous, ciliate at the edge; petals obovate-oblong; filaments glabrous; ovary and style glabrous.

North-West Prov., Dharmigadh, Jaunsar district, alt. 4,000 ft., flowering in May (*J. S. Gamble*, h. Calcutt.).

2. *Filaments pilose.*

μ. *Talbotii* n. var.

Leaflets 4-jugate, up to 12 cm. long, up to 5 cm. wide, subobliquely oblong-ovate, long-acuminate, the point subulate; the base attenuate below, rounded, wider and a little longer above; panicle as long as the leaves, loosely branched, glabrous; petals oblong, obtuse at both ends, 4.5 mm. long, 2 mm. wide; the connective sometimes long acuminate, ovary hirsute at the base only.

Northern Canara (*Talbot*. n. 325, h. Calcutt.).

v. australis n. var.

Leaflets up to 12.5 cm. long and up to 5 cm. wide, subobliquely oblong-ovate, acutely acuminate, the base tapering below, rounded and a little longer above; panicle as long as the leaves, loosely and shortly branched, glabrous; sepals rounded, glabrous, ciliate at the edge; petals elliptic, obtuse at both ends; filaments pilose; ovary and style glabrous; capsule obovate-oblong, fuscous when dry; nearly elenticellate; seed as in the type.—*C. Australis* F. Muell. *Fragm.* 1, p. 4; *C. DC. Mon. Phan.* 1, p. 743, tab. ix, fig. 5 (with filaments erroneously glabrous). *C. Toona* Benth. *Fl. Austr.* 1, p. 387. Red Cedar* of the colonists.

Littoral forests of eastern Australia (*F. Muell.* l. c.); Moreton Bay; Mackenzie's station (*Benth.* l. c.); Rockingham Bay (*Dallachy*, h. Calcutt.); Ipswich in Queensland (*Bedel*, *ibid.*); Brisbane (*Warburg* n. 19213, h. Berl.); Patterson river (*R. Brown*, *ibid.*); Hunter's river (*Cunningham*, h. Deless.).

ξ. parviflora Benth, l. c.

Leaflets up to 6 cm. long and to 28 mm. wide, ovate-lanceolate, acutely acuminate; the base tapering on both sides, longer and wider above; panicle about as long as the leaves, shortly pedunculate, loosely and shortly branched, nearly glabrous except on the ultimate branchlets; sepals ovate, acute at the top, glabrous, ciliate at the edge; petals oblong-elliptic, obtuse at both ends; filaments pilose.

New South Wales, Vicary (*Maitland*, h. Calcutt.); Hastings river (h. Berol.); Hunter's river (*Cunningham*, h. Deless.).

B.—Branchlets as well as the petioles rhachis and petiolules of the adult leaves pubescent. Column and ovary as in the type.

1. *Filaments glabrous.*

o. pubinervis n. var.

Leaflets alternate, 5 (or more?) on each side; up to 15.5 cm. long, and nearly to 6 cm. wide; oblong-ovate, acutely acuminate; the base

nearly of same length on both sides, tapering below, rounded above, both surfaces puberulous on the nerves; petals ovate-elliptic, obtuse at the top, about 4 mm. long, 2 mm. wide.

Himalaya (h. Calcutt.).

2. *Filaments pilose.*

π. *puberula* n. var.

Leaflets alternate or opposite, 5-10 on each side, 12-14 cm. long, 4.5-5 cm. wide, ovate-lanceolate acutely acuminate; the base tapering below, subtapering or rounded above; petiolules about 15 mm. long, petals oblong-elliptic, rounded at the top, 4.5 mm. long, 2.5 mm. wide; filaments sparingly pilose.

Kachin hills (*E. Pottinger, Shaik Mokim*; h. Calcutt., h. Monac.).

ρ. *Henryi* n. var.

Leaflets 12 cm. long, 4.5 cm. wide; upper surface puberulous on the central nerve, the lower as in the type; the base tapering on both sides, wider and a little longer above; petiolules 12 mm. long; flowering panicle much shorter than the leaves, loosely branched nearly from the base; petals elliptic, rounded at both ends, 4.5 mm. long, 2.5 mm. wide; filaments sparingly pilose. A tree 20 feet high.

China, prov. Yunnan, Szemao Mounts, alt. 5,000 ft.

(*A. Henry* n. 11963, h. Calcutt.)

σ. *pubescens* *Franch.* *Pl. Delav.*, p. 126;

Leaflets pubescent on both surfaces when young, afterwards glabrous except in the axils of the secondary nerves, about 9 cm. long, up to 3 cm. wide, oblong-lanceolate, acutely acuminate, the base tapering and of the same length on both sides; petiolules up to 9 mm. long; petals subovate-oblong, subacute at the top, 4.5 mm. long, 1.5 mm. wide; filaments sparingly pilose; style hirsute. A tree 20 ft. high.

China, Prov. Yunnan, Szemao Mounts. in the forest, alt. 5,000 ft. (*A. Henry* n. 11963A, h. Calcutt., h. Berol.); forests Tapintze (*Delavey*, h. Berol., h. Mus. Par.).

τ. *sublaxiflora* n. var.

Leaflets opposite or alternate, up to 13 cm. long and to 3.5 cm. wide, oblong-lanceolate, acutely acuminate, the base tapering and of same length on both sides; upper surface puberulous on the main nerve, under surface as in the type; petiolules about 8 mm. long; rather densely

pubescent as well as the rhachis, the petiole and the branchlets; petals oblong, subacute at the top, 5 mm. long, 2 mm. wide; filaments sparingly pilose.

China, Prov. Yunnan, alt. 4,600 ft. (*A. Henry* n. 9486A, h. Calcutt., h. Berol.).

C.—Flower unknown, seed as in the type.

v. Listerii n. var.

Branchlets and leaves as in the type, except that the lowest leaflets are remotely and acutely dentate at the edge; capsule only 2 cm. long.

Kasalong (*J. L. Lister*, h. Calcutt.).

D.—Flower and fruit unknown.

φ. Warburgii n. var.?

Leaflets opposite, petiolulate, up to 18 cm. long and to 7 cm. wide, oblong-elliptic, linear-acuminate at the top; the base tapering below, subrounded above; nerves hirtellous on both sides; as well as the petiolules and rhachis.—Vern. name '*Suren*.'

Java, Preanger, Tjilakei bei Pengalengan, alt. 1,300 m. (*Warburg* n. 3167, 3168, h. Berol.).

5. *C. microcarpa* C. DC. *Mon. Phan.*, I, p. 745.

Leaves glabrous; leaflets 9-jugate, opposite, petiolulate, more or less obliquely oblong-ovate, acutely acuminate, entire at the edge, the base tapering below, rounded wider and a little longer above; panicle a little shorter than the leaves, pedunculate, shortly branched, elongated, hirtellous; flowers pedicellate, pedicels densely hirtellous; sepals rounded, densely hirtellous outside, ciliate at the edge; petals oblong-obovate, subacute at the base, rounded and somewhat cucullate at the top, glabrous, ciliate at the edge; filaments densely pilose; anthers shorter than the filaments, oblong, cordate at the base, the connective apiculate; column and ovary densely hirsute, style glabrous; capsule elenticellate; seeds winged at both ends.—Gamble *Man. of Ind. Timb.*, p. 159. *C. Toona* *β. grandiflora* C. DC. l. c. *Toona microcarpa* Harms in *Engl. Pr. Pflanzf.* iii, p. 270.

A large evergreen tree (Gamble l. c.), branchlets puberulous and brown when young, later on dark-rubescens and glabrous. Leaves abruptly pinnate, up to 50 cm. long. Leaflets firm when dry, up to

12 cm. long, 4.5-5 cm. wide; the secondary nerves spreadingly-ascendent, subarcuate, about 12 on each side. Petiolules nearly 5 mm. long. Rhachis terete. Petiole 15 cm. long, terete. Peduncle of the panicle 4.5 cm. long; the lower branches of the panicle about 5 cm. long. Pedicels 1.5 mm., sepals 1 mm. long. Petals 6 mm. long, 3 mm. wide. Filaments 3 mm., anthers 1.75 mm. long. Staminodes 0. Column shorter than the cells of the ovary. Ovary 5-celled. Capsule elliptic, 2 cm. long, blackish when dry, the valves thin. Nepal (*Wall.* n. 9041, h. Calcutt.); Sikkim, alt. 4,000-5,000 ped. (*Hook.*, *Thoms.*, h. Cand., florif. specim. and ripe fruits, h. Calcutt., h. Monac., h. Berol., florif. specim. and unripe fruits, h. Monac., fruit only); W. Burma, vern. 'yetana' (*J. B. Dickinson*, h. Calcutt.); Australia where most likely not spontaneous (h. Deless.).

***β. grandifoliola* n. var.**

Leaflets alternate or opposite, 7-8 on each side, up to 18 cm. long and to 7 cm. wide, oblong-ovate, acutely and rather long acuminate; the base as in the type; panicle loosely branched, puberulous; sepals rounded, nearly glabrous on both surfaces, ciliate at the edge; petals oblong obtuse at the top, 5 mm. long, 2.5 mm. wide, sparingly puberulous at the base; filaments pilose, 2.5 mm. long; anthers 1 mm. long, the connective not apiculate; column and ovary as in the type; lower part of the style hirsute; fruit unknown.

Punkabari, Sikkim (h. Calcutt.).

6. *C. Kingii* n. sp.

Leaflets 4-6-jugate, opposite or subalternate, somewhat long petiolulate, ovate-lanceolate, acutely acuminate, entire and ciliate at the edge, the base tapering on both sides, wider and a little longer above, upper surface hirtellous above on the nerves, under surface densely hirsute; petiolules rhachis and petiole densely hirsute; panicle about as long as the leaves, branched from near the base, velvety-hirtellous; flowers somewhat long pedicellate, pedicels hirtellous; sepals rotundate-ovate, subacute at the top, hirsute outside and ciliate at the edge; petals oblong-obovate or obovate, obtuse at the base, rounded at the top, glabrous on both surfaces, ciliate at the edge; filaments sparingly pilose, anthers shorter than the filaments, elliptic, cordate at the base, the connective apiculate; column and ovary hirsute; style glabrous.

Branchlets hirsute, fulvescent when dry. Leaves abruptly pinnate, about 30 cm. long. Leaflets brown when dry, about 10.5 cm. long, 3.5

cm. wide, secondary nerves spreading-subascendent, straight, about 14 on each side. Petiolules 7 mm. long. Rhachis terete. Petiole terete, 5.5 cm. long. Lower branches of the panicle up to 18 cm. long. Pedicels 1.5 mm., sepals .75 mm. long. Petals 4.5 mm. long, 2 mm. wide. Filaments 1.5 mm., anthers .75 mm. long. Staminodes 0. Column shorter than the cells of the ovary. Ovary 5-celled, cells 6-ovulate; unripe seeds winged at both ends.

Sikkim Himalaya (*G. King*, h. Calcutt., flowering specimen); Lahore distr., only one leaf 62 cm. long, less hairy, from a young tree having a greenish grey and very smooth bark (*J. S. Gamble* n. 23384, h. Calcutt.).

β. birmanica.

Leaflets 5-9-jugate, oblong-lanceolate, up to 11 cm. long and up to 4 cm. wide; petiolules up to 12 mm. long; flower unknown; capsule oblong-obovate, rather slender, black when dry, with minute and paler lenticels, 2 cm. long, the valves only 5 mm. wide; seed winged at both ends, upper wing shorter and obtuse, the lower acute.—*C. Toona* Kurz; For. Fl., p. 228, p. p. '*Thit Kador*' of the Burmese. (Kurz Sp. quoted below.)

Upper Burma, Kachin hills (*Shaik Mokim*, h. Calcutt.); Pegu (*Kurz*, h. Calcutt.).

7. *C. febrifuga* *Bl. Bijdr.*, i, p. 180.

Leaflets 6-12-jugate, opposite or subopposite, petiolulate, ovate-oblong, subobliquely acutely and rather long acuminate, entire at the edge; the base tapering below, rounded or subrounded and a little longer above; upper surface minutely puberulous on the main nerve only, lower surface sparingly pilose in the axils of the secondary nerves only; petiolules and rhachis minutely puberulous; panicles as long as the leaves, pyramidically branched, densely puberulous; flowers pedicellate, pedicels puberulous; calyx cupulate, bluntly 5-dentate, rather densely puberulous outside, nearly glabrous inside, ciliolate at the edge; petals oblong-ovate, subattenuate-obtuse at both ends, hirsute on both surfaces, especially near the middle, ciliate at the edge; filaments pilose; anthers shorter than the filaments, elliptic, the connective obtuse or very shortly apiculate; column and ovary densely hirsute; style glabrous; capsule obovate-fusiform, lenticellate; seed equally or nearly equally winged at both ends.—*Surenus* Rumph. Amb. iii, tab. 39; *S. febrifuga* O. Ktze. Rev. i, p. 111 *Swietenia Surenii*

Bl. Cat. Hort. Buit. (f. Roemer). *Toona febrifuga* Roem. Syn. i, p. 139; Pierre Fl. For. 23; *Cedrela febrifuga*, A. Juss. Mem. Mel., p. 103; Don. Gen. Syst. i, p. 687; Forsten Diss., p. 16 cum icone; Hassk. Cat. Hort. Bogor, p. 129; Miq. Ann. Mus. Bot. 4, p. 63; C. DC. Mon. Phan. i, p. 744; King Mat. Mal. 7, p. 577; Koord et Val. Bijdr. 3, p. 202. *C. Toona* Miq. Fl. Ind. Bat. i, pars 2, p. 548, p. p.; Hiern Fl. Brit. Ind. i, p. 569, p. p.; non *C. Toona* C. DC. l. c. p. 745; *C. Teysmanni* Hassk. Hort. Bogor. i, p. 135; *C. odorata* Blanco. Flor. Phil., ed. I, p. 184.

A tree up to 180 ft. high; branchlets densely pubescent when young, afterwards glabrous, dark-reddish with pale lenticels when dry. Leaves abruptly pinnate, 30-50 cm. long. Leaflets 11.5-20 cm. long, 4.5-7.5 cm. wide; secondary nerves spreading-subascending, arcuate, about 12-15 on each side. Petiolules about 6 mm. long. Rhachis subterete. Petiole terete, up to 10.5 cm. long. Lower branches of the panicle 25-30 cm. long; branchlets floriferous from the base. Pedicels about 1 mm. long. Calyx 1 mm. long, lobes rounded. Petals about 4 mm. long, 1.5 mm. wide. Filaments 5 mm. long, anthers 1 mm. long. Staminodes 5 mm. long. Ovary 5-celled, cells 6-ovulate. Capsule 18-22 mm. long.

Perak, dense j. alt. 400-600 ft. (King's collector n. 10403,
h. Calcutt., h. Berl. lang (Curtis n. 826 fide. King l. c.).

Java (h. Cand., p., Holm. ex h. Lugd. bat.; *Funghuhn* n. 50, h. Calcutt.; *Koord* .l. n. 4825 β , 4835 β , 14575 β , h. Calcutt., n. 4835, h. Cand.) oevingie (*Teysm.*, h. Calcutt.).

Philippines Mindoro (*D. Merrill* n. 2372, h. Berl.) ?; Luzon
(*G. P. Mann* h. Berol.) ?.

β. glabrio *NC. l. c.*

Leaflets glabrous except underneath in the axils of the secondary nerves; base acute or subacute on both sides, a little longer above; petioles pubescent than in the type or even glabrous, the connective only apiculate.

Java (Anger n. 946, h. Cand., h. Berol. not n. 9467 as in C. DC. M. Phan.).

γ. inc 1 n. var.

Leaflets quite glabrous except underneath in the axils of the secondary nerves; petiolules and rhachis glabrous; flowers unknown; wood whitish, inodorous.—*C. inodora* Hassk. Hort. Bog., p. 131; Hochr. Pl. Bogor-exsic. n. 157, Hort. Bogor. e Sumatra? (Hochr. l. c.).

δ. assamensis n. var.

Leaflets up to 13 cm. long and to 4.5 cm. wide, ovate-lanceolate, rather long and acutely acuminate; the base subacute on both sides, a little longer above; secondary nerves subspreading substraight; petals 5 mm. long, 2.5 mm. wide, oblong-elliptic, obtuse at both ends, minutely puberulous on both surfaces; capsule obovate-fusiform, reddish when dry, up to 4 cm. long; seed winged at both ends, upper wing shorter than the lower. Vernacular name "*Fata Poma*."

Branchlets glabrous, pale reddish when dry, with a few pale brown lenticels.

Sibsagor (*G. E. Peal*, h. Calcutt.).

§. *Pealii* n. var.

Leaflets up to 10.5 cm. long and to 5 cm. wide; ovate, subacutely acuminate, the base tapering below, rounded and a little longer above; secondary nerves spreading, subarcuate; calyx glabrous, rugulose outside; petals oblong-elliptic, obtuse at both ends, glabrous outside, sparingly pilose inside; lower ovary unknown. Vernacular name "*F. Poma*".

Branchlets glabrous, pale reddish when dry, lenticellate.

Sibsagor (*G. E. Peal* n. 275, h. Calcutt.).

§. *Cochinchinensis*

Leaflets and petals as in the preceding, upper wing of the seed a little shorter than the lower. *Toona* ~~cf. *br.*~~ *uga*, var. *cochinchinensis* Pierre l. c., tab. 388A.

Cochinchina, prov. Bian Hoa (*Pierre*, h. Calcutt.).

η. *verrucosa* n. var.

Leaves glabrous; rhachis and petiole together with the branchlets of the panicle and the capsules covered with verrucose lenticels; upper wing of the seed rather shorter than the lower.

Bhutan Himalaya (h. Calcutt.); Sikkim, alt. 5,000-6,000 ft. (*S. A. Gammie*, h. Calcutt., h. Cand.); Darjeeling, alt. 5,000 ft. (*J. S. Gamble* n. 9618, h. Calcutt.); upper Burma, Kachin hills, alt. 5,500 ft., Sima road (*Shaik Mokim*, h. Calcutt., h. Cand.).

Sumatra forest on Mount Kaba, alt. 3,500 ft. (*H. O. Forbes*, h. Calcutt.; n. 2881, h. Berl.).

8. *C. Mannii* n. sp.

Leaflets 6-7-jugate, opposite or subopposite, very shortly petiolulate, oblong or the lower ones ovate-oblong, somewhat obtusely acuminate, the edges entire, the base subequally rounded on both sides, the upper surface minutely puberulous on the main nerve only, the under surface quite glabrous; rhachis and petiole minutely puberulous;

panicles minutely puberulous; flowers pedicellate; pedicels puberulous; calyx bluntly 5-dentate, puberulous outside, ciliolate at the edges; petals oblong, obtuse at both ends, glabrous, ciliate at the edges, filaments densely pilose; anthers much shorter than the filaments, elliptic, cordate at the base, the connective blunt; column and ovary hirsute; the ovules partly inside the column; style glabrous.

Leaves more than 33 cm. long. Leaflets up to 11 cm. long and to 42 mm. wide; secondary nerves spreading, nearly straight, about 20 on each side. Petiolules 2 mm. long. Rhachis and petiole terete. Lower branches of the panicle up to 20 cm. long. Pedicels 1.5 mm. long. Calyx 1 mm. long, the teeth rounded. Petals 5 mm. long, 2 mm. wide. Filaments 2 mm., anthers .75 mm. long. Staminodes 0. Column shorter than the cells of the ovary. Ovary 3-celled, lower ovules within the column.

Khasia (*G. Mann.*, h. Cand.).

9. *C. longifolia* Wall. *Cat.* n. 1273.

Leaflets 11-12-jugate, opposite, subsessile or the lower ones very shortly petiolulate, oblong-lanceolate, long and acutely acuminate, subremotely serrulate, the base tapering on both sides equal or unequal in the lower leaflets, upper surface glabrous, under surface sparingly pilose in the axils of the secondary nerves only; panicles densely pubescent; flowers shortly pedicellate, pedicels puberulous; calyx cupulate, subacutely 5-dentate, glabrous outside, appressedly puberulous inside, ciliate at the edge; petals elliptic-oblong, obtuse at both ends, glabrous outside, with a few hairs at the base inside, not ciliate at the edges; filaments glabrous; anthers shorter than the filaments, oblong, cordate at the base, the connective subapiculate; column and ovary glabrous.—*C. Toona* Wall. *Cat.* p. p.; DC. *Prodr.* 1, p. 624; A. Juss. *Mém. Mel.*, p. 103. *C. glabra* C. DC. *Mon. Phan.* 1, p. 742.—*Toona longifolia* Roem. *Syn.*, fasc. i, p. 140. *T. glabra* Harms in *Engl. Pr. Pfanzf.* iii, 4, p. 269.

A tree; branchlets glabrous, dark-reddish when dry, with few pale lenticels. Leaves abruptly pinnate, up to 70 cm. long. Leaflets about 12.5 cm. long, 3.5 cm. wide, denticles obtuse or subobtusé; secondary nerves subspreading, nearly straight, about 14 on each side. Petiolules up to 2 mm. long. Rhachis subterete, petiole terete 7 cm. long, both puberulous when young, afterwards nearly quite glabrous. Pedicels .75 mm. long. Calyx nearly 1.5 mm. long. Petals 5 mm. long, 2 mm. wide. Filaments 2.5 mm., anthers 1.5 mm. long. Staminodes 0. Column shorter than the cells of the ovary. Ovary 5-celled, the cells

6-8- ovulate. Capsule about 2.5 cm. long, blackish elenticellate. Seed unknown.

Napalia (*Wall.* 1821, sine n., h. DC.); Ava? (*Wall.* n. 1273, h. DC. Mon. Phan., h. Calcutt. sub *C. longifolia*).

β. kumaona n. var.

Leaflets loosely pilose underneath on the nerves; panicles subglabrous; lobes of the calyx rounded, obtuse or subacute at the top; the connective obtuse or subobtuse, seeds winged at the upper end only, 15 mm. long, wing oblong, obtuse. A tall tree.

Kumaon, upper Tola, alt. 6,400 ft. (*R. Strachey* et *J. E. Winterbottom*, h. Calcutt.); Hazara (*Stewart*, h. Calcutt.).

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